

Application No. 10/550,564  
After Final Office Action of April 17, 2008

7

Docket No.: 63907(71526)

### **REMARKS**

Claims 1 - 6 are currently pending in the application. No claims have been cancelled. No claims have been amended. New claim 7 has been added. No new matter has been added, support being found in the claims and specification as originally filed.

The Examiner has acknowledged the supplemental Information Disclosure Statement.

#### **Claim Rejections 35 U.S.C. §103**

Claims 1 - 6 have been rejected under 35 U.S.C. § 103(a) over Davis et al (US 5756838; the '838 reference herein) in view of Ishizaki et al. (US 5274146; the '146 reference herein) and Ishizaki et al. (US 5324861; the '861 reference herein). Applicants respectfully traverse the rejection.

The instant claims recite a method for producing an optically active carboxylic acid represented by the formula [2], comprising the step of subjecting an unsaturated carboxylic acid formula [1] in water or a mixed solvent of water and a water-insoluble organic solvent in the presence of a sulfonated BINAP-Ru complex represented by the formula [3].

The Examiner argues that the US '838 reference teaches "a method for conducting asymmetric reactions of prochiral unsaturated bonds contained within a compound using the water soluble chiral sulfonated 2,2'-bis(diphenylphosphino)-1,1'-binaphthyl organometallic catalyst." (Office Action, p.3). In particular, the Examiner argues that "(e)xample 9 teaches that hydrogenation of 2-(methoxy-2'-naphthyl) acrylic acid using various combinations of water or water with organic solvent, where us '838 disclosed that the water content of the SAP catalyst is highly dependent on the water content in the SAP catalyst." (Office Action, p.3).

Example 9 (cols 15 -16 of the '838 reference), as pointed to by the Examiner, exemplifies claim 1 of US' 838, below:

(Claim 1) A method for conducting an asymmetric reaction to a prochiral unsaturated bond contained within a

BOS2 680031.2

Application No. 10/550,564  
After Final Office Action of April 17, 2008

8

Docket No.: 63907(71526)

compound comprising the step of contacting said compound with a supported highly-polar liquid-phase catalyst comprising an organometallic compound which comprises a metal and an enantiomerically pure chiral sulfonated 2.2'-bis(diphenylphosphino)-1.1'-binaphthyl, wherein each phenyl group of the sulfonated binaphthyl is monosulfonated, and wherein the degree to which the sulfonated binaphthyl is sulfonated is selected from the group consisting of tetrasulfonated, pentasulfonated and hexasulfonated.

The Examiner argues that "one of ordinary skill in the art wanting to use the asymmetric hydrogenation of unsaturated carboxylic acids of US' 838 would have found it obvious to employ the catalysts of the cited prior art references, US '861 and US' 146 (and)...would look for alternate and equivalent materials through routine experimentation." (Office Action, p.4 - 5). Applicants disagree.

In order to achieve the invention recited in Claim 1 of the present application as compared to achieving Claim 1 of US'838, a number of additional steps are required. First, one of skill in the art is required to:

**replace** an enantiomerically pure chiral sulfonated 2.2'-bis(diphenylphosphino)-1.1'-binaphthyl, wherein each phenyl group of the sulfonated binaphthyl is monosulfonated, and wherein the degree to which the sulfonated binaphthyl is sulfonated is selected from the group consisting of tetrasulfonated, pentasulfonated and hexasulfonated" as set forth in the US '838 reference with SO<sub>3</sub>A-BINAP represented by formula (II) in Claim 1 of US'861 or US '146.

In addition; one of skill in the art is also required to:

**extract** a catalytic complex from a supported highly polar liquid-phase catalyst;

**dissolve** the catalytic complex in an aqueous solvent,

**subject** a substrate to the catalytic complex in an aqueous solvent.

Furthermore, one of skill in the art would have to **choose** the US' 146 and US' 861 methods to modify with the above steps of the instant invention. So many modifications and steps are hardly obvious to the ordinary artisan.

One of skill in the art would easily understand that the special structures defined in Claim 1 of US' 838, e.g. a metal and an enantiomerically pure chiral sulfonated 2.2'-

BOS2 680031.2

JUL 17 2008

Application No. 10/550,564  
After Final Office Action of April 17, 2008

9

Docket No.: 63907(71526)

bis(diphenylphosphino)-1.1'-binaphthyl, are essential technical features of the invention of Claim 1 of US'838. In US '838, there is no motivation or suggestion to change or replace the essential technical features such that instant Claim 1 may be achieved.

Moreover, the instant invention requires the steps of extracting the catalytic complex and dissolving the catalytic complex, as set forth in the claims, and said steps are necessary to achieve the optically active carboxylic acid represented by the formula [2] as recited in Claim 1. Nowhere does the US '838 reference or any of the secondary references teach or suggest these steps as instantly claimed.

In contrast, the US '838 reference teaches that "a supported highly-polar liquid-phase catalyst (SAP catalyst) comprising an organometallic compound which comprises a metal and an enantiomerically pure chiral sulfonated 2.2'-bis(diphenylphosphino)-1.1'-binaphthyl" is an essential feature of the invention. Thus, one skilled in the art who understand the invention of US'838 would not be motivated to skip such an essential feature, i.e. SAP structure, in the method as claimed. In removing such a feature, the method as claimed would not be achieved.

Further, because the method steps of the present invention are different from the invention of US'838 as represented by the above steps, the resulting optical purity is significantly higher.

For instance, the optical purity of Example 9 of US'838 is as low as 28.7 - 77.0%. Applicants point out Entry 1 of Table 8, that indicates that in cases where SAP is used, unless the support condition is constantly adjusted, the optical purity becomes very low. However, in contrast to US'838, the optical purity in the present invention is high, for example, 92.2 - 92.5% in Table 1 (Example 2), 93.2 - 94.0% Table 2 (Example 6) and 92.1 - 93.1% ee in Table 3 (Examples 7 - 10).

One of skill in the art understands that the improvement of optical purity more than 10% is not routine and is very difficult to achieve.

The '838 reference does not teach every element of the invention as claimed, and the '861 and '146 references do not cure the defects of the US' 838 reference. Together, none of the cited references teach the method for producing an optically active carboxylic acid represented by the formula [2] as claimed and, moreover, would indicate unpredictable results from a combination of US'838 with US '861 and US '146.

BOS2 680031.2

JUL 17 2008

Application No: 10/550,564  
After Final Office Action of April 17, 2008

10

Docket No.: 63907(71526)

Accordingly, Applicants respectfully request that the rejection be withdrawn and the claims allowed.

It is believed the application is in condition for immediate allowance, which action is earnestly solicited.

**FEE AUTHORIZATION**

Should any fees associated with this submission be required, the Commissioner is authorized to charge our Deposit Account, No. 04-1105. Any overpayment should be credited to said Deposit Account, with reference to attorney docket 63907(71526).

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Respectfully submitted,

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BOS2 680031.2